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**Object-based broadcasting – for European leadership in next generation audio experiences**

### **D3.1: Requirements, designs and workflows of an object-based production environment**

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#### *Abstract*

This document presents high-level descriptions of live radio production, including workflow diagrams, roles activities and timelines. Proposed workflows for object-based productions are also described.

[End of abstract]

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## Executive Summary

This document presents high-level descriptions of live radio production, including workflow diagrams, roles activities and timelines. Proposed workflows for object-based productions are also described.

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## Abbreviations

<b>ARD</b>	Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland
<b>BBC</b>	British Broadcasting Corporation
<b>BR</b>	Bayerischer Rundfunk
<b>CMS</b>	Content Management System
<b>DAW</b>	Digital Audio Workstation
<b>EPG</b>	Electronic Programme Guide
<b>IP</b>	Internet Protocol
<b>OB</b>	Outside Broadcast
<b>RDS</b>	Radio Data System
<b>SMS</b>	Short Message Service

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## 1 Introduction

Radio has been produced since the 1920s, during which time the process has evolved with emerging technology. However, the process remains broadly similar and hasn't yet fully exploited the opportunities presented by modern networking, semantic audio and data management technology. In considering how we design a new object-based production environment, it is important to consider the current techniques and workflows which have evolved over more than a century.

This document aims to give an overview of the requirements, design and workflow behind radio production today, and consider what it might look like in an object-based world. This will act as the basis for developments by the Orpheus project in creating a new object-based production system.

### 1.1 Structure

This document starts by describing the principles of radio broadcasting, including formats, planning, timeline, documentation and roles involved. It then describes the production workflow through a number of case studies covering a variety of different radio programme formats. An overview of each case study is given along with an example workflow and list of roles and equipment used. Additionally, a suggested workflow for an object-based production is described for each case study.

### 1.2 Contributors

- BBC Research and Development
- BBC Radio Engineering
- BR Radio

### 1.3 Scope

The focus in this paper lies on 'live' production and play-out. Pre-recorded formats such as radio documentaries and radio drama, as well as music production – pre-recorded classical and popular are, for the moment, excluded from this process as they have unique requirements and will not be implemented as part of the first Orpheus pilot. However, the recorded output of the live productions may be used as input material to a pre-recorded production workflow.



## 2 Planning and documentation

This section describes the principles of radio production and the features that are common to all types of radio programmes. We start off by considering the different formats of programmes that exist, before detailing how they are planned, what documentation is generated before and after the broadcast, and which roles and responsibilities exist in this process.

### 2.1 Format

Many radio stations (or 'networks') characterise themselves by having a defined format. The two most common of these are as follows:

- 'music oriented': classical, jazz, easy listening, rock, plus numerous sub-genres
- 'spoken word': news radio, sports, talk radio, children's, education etc.

The choice of the station format is often driven by having a specific target audience or demographic (e.g. music station for young people), commercial motivation based on advertising, or a public service obligation (e.g. BBC Charter).

Radio operators usually organise themselves to have a mixture of various genres across their stations with a scope that includes music, news, background on current affairs, call-in and talk programmes, to more highbrow genres like controversial discussions, radio documentaries, literature and drama, plus (live) concerts of music etc. Some 'full-service' stations also offer such a variety on a single station.

### 2.2 Programming and Planning

Producing a live stream of audio that runs 24 hours a day requires meticulous planning. This includes dividing up the available air-time, capturing, presenting and storing the necessary information, and assigning responsibilities to the numerous people involved in running the programmes and stations.

Programming and planning of broadcasts is done on two levels which are described in detail below:

- macro: long term, a few weeks (sometimes months) ahead, which considers the layout of a day's programme, i.e. the sequence of reserved slots to be filled by different editorial departments
- micro: the actual filling of segmented air-time with single elements, i.e. single spoken contributions or music

#### 2.2.1 Macro programming: Dayparting

On a macro level, a radio station has a schedule (or 'scheme') consisting of a sequence of different entities and shows (i.e. morning show, late night show ...) called 'dayparting'. This overall scheme runs throughout the year, with occasionally seasonable variations and adaptations (e.g. Christmas and other holidays).

Throughout the working days of a week, mostly the same or similar schemes are used. However, schemes for Saturdays and Sundays vary, often significantly, as it is expected that the audience gives more time and attention to listening.

In any case, a typical radio station schedule defines the framework and horizon of expectation of the content to be delivered to the target audience. The structure of the programme is oriented towards usability, making it attractive, and retaining the audience as much as possible.

Ambitious full-service cultural programmes (like *BBC Radio 4* or *Bayern 2*) are characterized by a sequence of different shows and diverse genres. The sequence and content of full-service radio

programmes, like TV programmes, is published before in print of own (e.g., *BR-Magazin*) or third party listings magazines and newspapers, on a station’s website, as well as in an EPG (electronic program guide) in smartphone apps, digital TVs or digital radios equipped with displays. Devices with an EPG may offer additional functionalities to mark, remind or recommend and share via social media, or even record a program locally on the device.

BBC RADIO 4		BR BAYERN	
6:00	TODAY MORNING NEWS. INCLUDES SPORTS DESK, WEATHER, THOUGHT FOR TODAY	6:05	RADIOWELT (news and current affairs, music)
9:00	DOCUMENTARY/FEATURE	8:30	KULTURWELT (cultural news)
9:30	ONE TO ONE TALK	9:05	RADIOWISSEN (general knowledge and education)
9:45	BOOK OF THE WEEK	10:00	NOTIZBUCH (magazine: focus on one or two subject(s), different perspectives and approaches, interviews, reportages, background, inbetween music)
10:00	WOMAN’S HOUR PROGRAMME THAT OFFERS A FEMALE PERSPECTIVE ON THE WORLD	12:05	DAS TAGESGESPRÄCH (today’s talk with expert(s) an audience call-in)
10:45	15 MINUTE DRAMA	13:05	RADIOWELT news and current affairs, music)
11:00	DOCUMENTARY/FEATURE		
11:30	DOCUMENTARY/FEATURE		
12:00	NEWS SUMMARY		
.....			

Figure 1: Morning scheme of comparable ‘full-service’ radio programs from BBC and BR

Therefore, the following basic information about of the content of a program has to be collected and disseminated well ahead of it going on air. This basic information comprises also the framework data for EPG distribution.

- start and stop time
- title
- subtitle
- short description of content (sometimes in various lengths)
- possibly additional categories on genre, format etc.

The timespan over which this framework of data is coordinated and passed around varies from station to station, or broadcast organisation, depending on established planning, commissioning and editorial workflows. For example at BR, planning for ‘semi-current affairs’, according to the overall schedule of a full-service programme, starts around 12 weeks ahead, with an editorial deadline 8 weeks before airing. Public announcement of, and access to, this data is given an average of 4 weeks ahead broadcast.

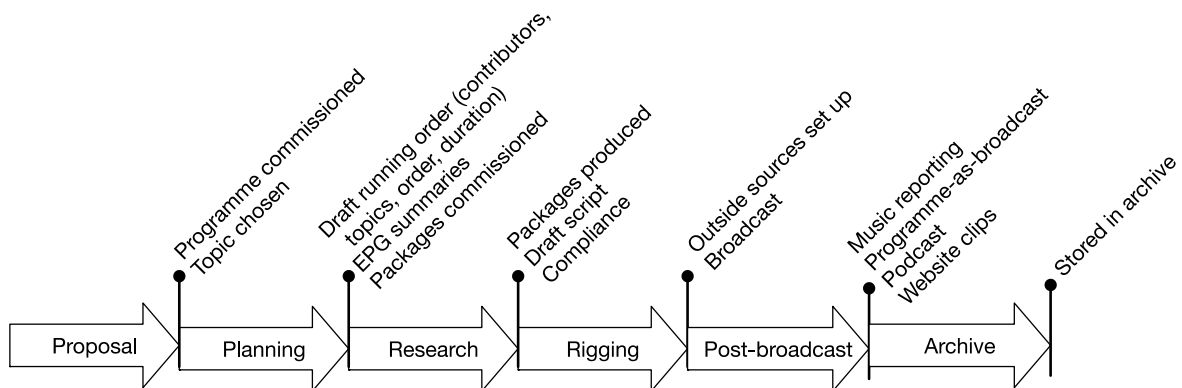


Figure 2: Simple workflow of broadcast planning

As not all data for up-to-the-minute planned broadcasts might be available at different phases of program publishing deadlines, time-based job schedulers (cron) on interacting systems for play-out, EPG or web publications (CMS) fulfill the task of updating necessary information regularly.

Larger formats such as full-length features, documentaries, radio drama or live transmissions of concerts and events are planned, commissioned and produced even further ahead, up to one year before, and involve much more complex processes.

### 2.2.2 Micro programming: Hour clock

News and current affairs shows and talks are compiled on a daily basis, on-the-go, at times even edited on-the-fly whilst the programme is on air. Basically, the same processes, rules and responsibilities as in mid-term or long-term planning do apply, but under much more time- and decision-critical conditions. Therefore, these tasks are taken by highly specialized, task-sharing and rehearsed teams in newsrooms.

Also, most of the music scheduling for full-time music stations or for mixed programmes is nowadays selected and compiled by, or with support of, computerized ‘music scheduling’ or ‘music rotation’ systems. The music is normally selected to in order to represent the character of that station.

In DJ and magazine programmes, ‘hour clocks’ are a common tool used to structure the sequence and diversity of the programme’s elements.

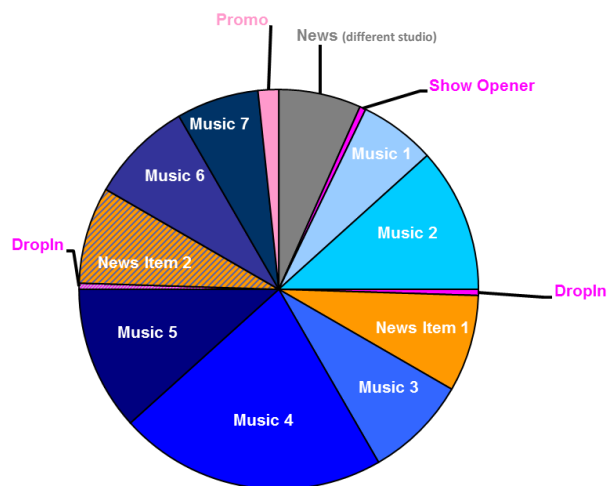
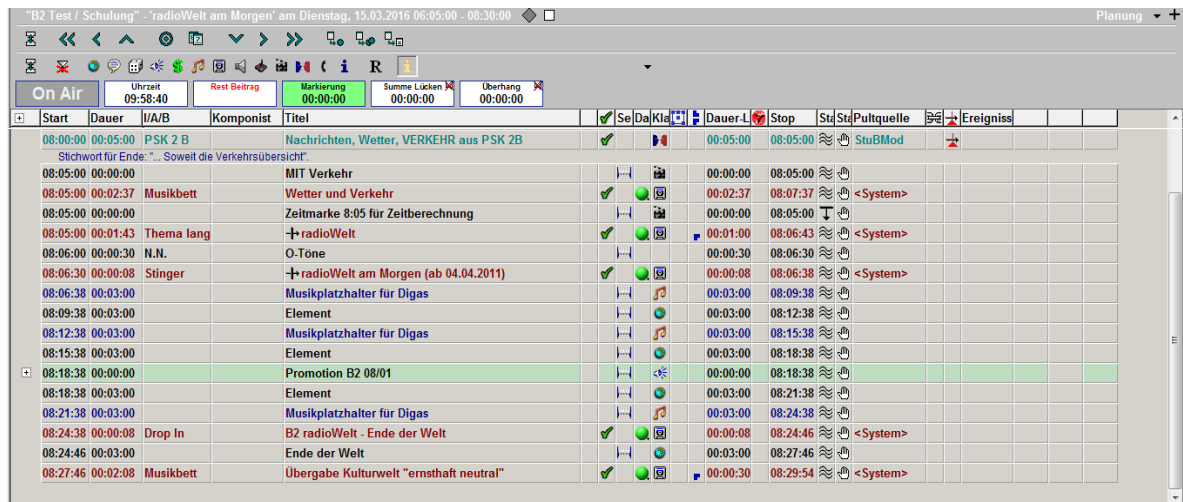


Figure 3: Hour-clock of a music programme with news items

In modern broadcast play-out systems this structure is transformed into templates of a rundown sequence (or ‘running order’) for each show. Here, fixed layout and sound-design elements (i.e. show-opener, drop-ins etc.) are linked to existing files in media asset databases, whereas placeholders reserved for music and news items can be attached or replaced even during the actual play-out with delivered up-to-the-minute content.



Start	Dauer	I/A/B	Komponist	Titel	Se	Da	Kla	Dauer-L	Stop	Stz	Stz	Pultquelle	Ereigniss
08:00:00	00:05:00	PSK 2 B		Nachrichten, Wetter, VERKEHR aus PSK 2B	✓			00:05:00	08:05:00			StuBMod	
08:05:00	00:00:00			MIT Verkehr				00:00:00	08:05:00				
08:05:00	00:02:37	Musikbett		Wetter und Verkehr	✓			00:02:37	08:07:37			<System>	
08:05:00	00:00:00			Zeitarke 8:05 für Zeitberechnung				00:00:00	08:05:00				
08:05:00	00:01:43	Thema lang		radioWelt	✓			00:01:00	08:06:43			<System>	
08:06:00	00:00:30	N.N.		O-Töne				00:00:30	08:06:30				
08:06:30	00:00:08	Stinger		radioWelt am Morgen (ab 04.04.2011)	✓			00:00:08	08:06:38			<System>	
08:06:38	00:03:00			Musikplatzhalter für Digas				00:03:00	08:09:38				
08:09:38	00:03:00			Element				00:03:00	08:12:38				
08:12:38	00:03:00			Musikplatzhalter für Digas				00:03:00	08:15:38				
08:15:38	00:03:00			Element				00:03:00	08:18:38				
08:18:38	00:00:00			Promotion B2 08/01				00:00:00	08:18:38				
08:18:38	00:03:00			Element				00:03:00	08:21:38				
08:21:38	00:03:00			Musikplatzhalter für Digas				00:03:00	08:24:38				
08:24:38	00:00:08	Drop In		B2 radioWelt - Ende der Welt	✓			00:00:08	08:24:46			<System>	
08:24:46	00:03:00			Ende der Welt				00:03:00	08:27:46				
08:27:46	00:02:08	Musikbett		Übergabe Kulturwelt "ernsthaft neutral"	✓			00:00:30	08:29:54			<System>	

Figure 4: Rundown template of broadcast radio play-out system – planning instance

The metadata of single elements – i.e. title and author of news items, music title, performer composer of music items etc. – is used for dissemination in radio data systems (dira! Radio, RDS, DL), or ID3 tags of podcasts, streams etc. and in addition, with more details, for internal documentation and reporting (performance rights organization: PPL, PPR, GEMA).

Whilst the programme is on-air, entries for all assigned additional sources on the mixing desk (i.e. microphones in the studio, outside connections, telephone, CD players...) are inserted real-time.

The total output of pre-planned or spontaneously-added elements and sources are attributed with 'start-stop bits' in the outgoing digital data stream and are logged meticulously for later evaluation and reporting.

## 2.3 Documentation

Within the course of planning, producing, airing and after broadcasts, a lot of documentation is generated. Depending on different states of digitalisation in broadcast organisations, and habits of editorial departments, paper is still printed out and manually passed throughout the production workflows. Alternatively, available digital metadata is captured, propagated, stored within networks, assigned to control additional functionalities or even made publically available.

This section describes the 'documents' that are typically generated during radio production throughout the various stages. These documents represent a basic set that is common across the different programme formats and genres:

### 2.3.1 Pre-broadcast

- **Running order**

The running order (RO) is list of items in order of time in the programme. Items might include a programme intro, a discussion topic, or a link between topics. Each item will have a target duration time associated with it.

- **Script**

The script contains pre-written text for the presenter to read out on-air. Not all parts of the programme will be scripted, in which case the script will contain notes from the producer on suggested points of discussion.

- **EPG summaries**

Also known as 'billings', these are paragraphs describing the programme in a variety of

lengths (usually short, medium and long). This information feeds into electronic programming guides and the website.

- **Presentation details**

Two short scripts for the intro and outro to the programme. These are read by a continuity announcer before and after the broadcast (BBC only)

### 2.3.2 Post-broadcast

- **Music reporting**

A list of the music tracks that were played, partially or in full, during the broadcast and for how long. This is a legal requirement.

- **Programme as broadcast (BBC only)**

This document records basic facts about the programme. Different stations and programmes have different guidelines on what information should be recorded. For instance, magazine shows will record the running order, but documentaries will not. If the running order is available, each item will be populated with the presenter or contributors, subject matter and location. All of the music and clips broadcast during the programme will be listed, with details on the rights and the playback duration. If the running order is not available, the same type of information will be recorded, but for the programme as a whole.

## 3 Roles and activities

In a broadcasting organization there are many different roles and responsibilities. The ones described here briefly are related solely to front-line tasks: the planning, production and supervising of programmes.

Basically the work to be done to produce broadcasts are the same everywhere. However, different companies have different organisational structures and therefore job titles, job descriptions and related tasks and responsibilities may vary. It is also worth noting that certain roles can be filled or shared by different people simultaneously.

Finally, one has to be especially aware that although certain job titles in the UK (BBC) and Germany (ARD-BR) are the same, the job description may be completely different. Where necessary, this has been pointed out.

### 3.1 Producer (BBC) / Editor (BR)

The producer is the most senior member of the team and is responsible for the programme as a whole. They focus mostly on the editorial content of the programme, including putting together or adjusting the running order and the script.

Activities:

- A1 Write running order and script, modify before and during broadcast
- A2 Read running order and script, receive updates
- A3 Write and submit EPG summaries before broadcast (BBC)
- A4 Write and submit presentation details (intro/outro for continuity announcer) before broadcast
- A5 Fill in and submit compliance form
- A6 Communicate with other contributors over talkback
- A7 Create pre-recorded items to play during broadcast
- A24 Listen to studio output over headphones
- A25 Listen to studio output over loudspeakers

### 3.2 Assistant

The assistant helps the producer with administrative tasks such as booking contributors, rooms and studios. During the broadcast, they keep track of timings. Post-broadcast, they do the music reporting and programme-as-broadcast script.

Activities:

- A1 Write running order and script, modify before and during broadcast
- A2 Read running order and script, receive updates
- A8 Track timings in relation to the running order
- A9 Report the music that was played during the broadcast
- A10 Write and submit a 'programme as broadcast' document (BBC)
- A7 Create pre-recorded items to play during broadcast
- A24 Listen to studio output over headphones

A25 Listen to studio output over loudspeakers

A26 Monitor and filter social media, SMS and email. Send selected contributions to presenter

### 3.3 Engineer (live and in pre-production)

The engineer is responsible for the sound, including setting up the studio, mixing the microphone, recording and playback and any audio processing.

Activities:

A11 Mix, pan, EQ microphone signals

A12 Route links to/from outside sources

A6 Communicate with other contributors over talkback

A13 Play pre-recorded items

A14 Play music track from music playout system

A15 Record live output

A16 Send visual signal to the presenter (cue light)

A2 Read running order and script, receive updates

A17 Edit pre-recorded audio

A18 Turn broadcast output into a podcast version (BBC)

A19 Create short clips from the broadcast output for the website (BBC)

A20 Monitor audio quality of studio output

A25 Listen to studio output over loudspeakers

### 3.4 Presenter (BBC) /Moderator (BR)

The presenter is the voice of the programme. They use the running order and script to present the programme and lead discussions with the guests.

Activities:

A2 Read running order and script, receive updates

A6 Communicate with other contributors over talkback

A24 Listen to studio output over headphones

### 3.5 Guest

A discussion programme is based on having one or more guest contributors.

Activities:

A6 Communicate with other contributors over talkback

A24 Listen to studio output over headphones

### 3.6 Correspondent

A (foreign) correspondent is a broadcast journalist in one of the company's external studios or offices within the country or abroad.

A correspondent today is trained not only in journalism but has to have also good technical skills, as quite often they have to work completely on their own.

Tasks:

- A7 Create pre-recorded items to play during broadcast
- A2 Read running order and script, receive updates
- A6 Communicate with other contributors over talkback
- A24 Listen to studio output over headphones

### 3.7 DJ (self-driving presenter)

A DJ is not just the voice of – but has also the skills to run all technical tasks in - a live music programme (an engineer may still be around for technical support or to ensure the audio quality of the studio output). But not all parts of the ‘show’ have to be ‘live’. Interviews with guests in the studio are quite often pre-recorded.

Activities:

- A14 Play music track from music playout system
- A21 Play jingle from ‘cart player’ system
- A1 Write running order and script, modify before and during broadcast
- A2 Read running order and script, receive updates
- A24 Listen to studio output over headphones

### 3.8 Continuity announcer

Depending on the format of the radio program, radio announcers ‘on-air’ are permitted to show more or less ‘personality’. Also, in many radio ‘formats’ the classical ‘announcement’ of a ‘show’ or broadcast has been replaced by ‘sound-designed’ elements: ‘show-opener’, ‘jingles’, ‘promos’ etc. If not abolished, continuity announcers are to

Activities:

- A22 Read presentation details
- A24 Listen to studio output over headphones

### 3.9 Sound Director / Tonmeister

Especially in the production of classical music – live or recorded – the sound director or “Tonmeister” plays an additional role as artistic ‘director’, ‘supervisor’ or ‘producer’. It’s the connecting part between the artistic intention of the musician(s) – conductor, orchestra, ensemble, artists – and technical possibilities and realization.

Activities:

- A23 Make time-stamped notes during performance to assist editing in post-production
- A24 Listen to studio output over headphones
- A25 Listen to studio output over loudspeakers
- A27 Read musical score, follow along with music



## 4 Case study 1: Discussion programme

### 4.1 Overview

A discussion programme is characterised by having one or more guest contributors in conversation with a presenter. Examples include “Start the Week” (BBC) and “In Our Time” (BBC). From a technical perspective, this is one of the simplest formats as it usually only involves mixing a few different microphones.

After a topic for the discussion has been chosen, the producer starts by putting together a running order, writing EPG summaries, writing presentation details and booking guests. They will research the topic in detail to find interesting points to touch on which will refine the running order and form the basis of a script. At this point, some simple pre-recorded items may be put together to be used during broadcast. The producer may also fill out a compliance form to highlight any sensitive editorial content.

Following the broadcast, any music played must be reported and a final script of the ‘programme as broadcast’ must be filed. Any podcasts or website clips of the programme must be edited together and submitted to the relevant media management system.

### 4.2 Roles

- Producer
- Assistant
- Presenter
- Engineer
- Guests and contributors

### 4.3 Equipment

- Mixing desk and monitoring loudspeakers
- Recorder
- Microphones and headphones
- Talkback units
- Printer
- Foot pedal and cue light
- “On air” light

### 4.4 Existing workflow

During the broadcast, the presenter and guests each talk into their microphone. The microphone signals are monitored and mixed by the engineer (A11). The engineer, producer and assistant listen to the studio output through the loudspeakers in the cubicle or monitoring studio (A25). The presenter and guests listen to the output through their headphones (A24). The producer and engineer can use the talkback system to speak to the presenter and guests through their headphones (A6). The talkback interface allows them to select which of those people will hear the audio. The presenter and guests normally communicate back through the broadcast microphones. The engineer

will make a local recording of the broadcast (A15) so that it can later be repurposed for website clips (A19) and podcasts (A18). The producer may update the running order and script during the show (A1), either through a digital production system or by creating new printouts which are then distributed. The assistant will keep track of the live timings in relation to the running order and record the actual times (A8).

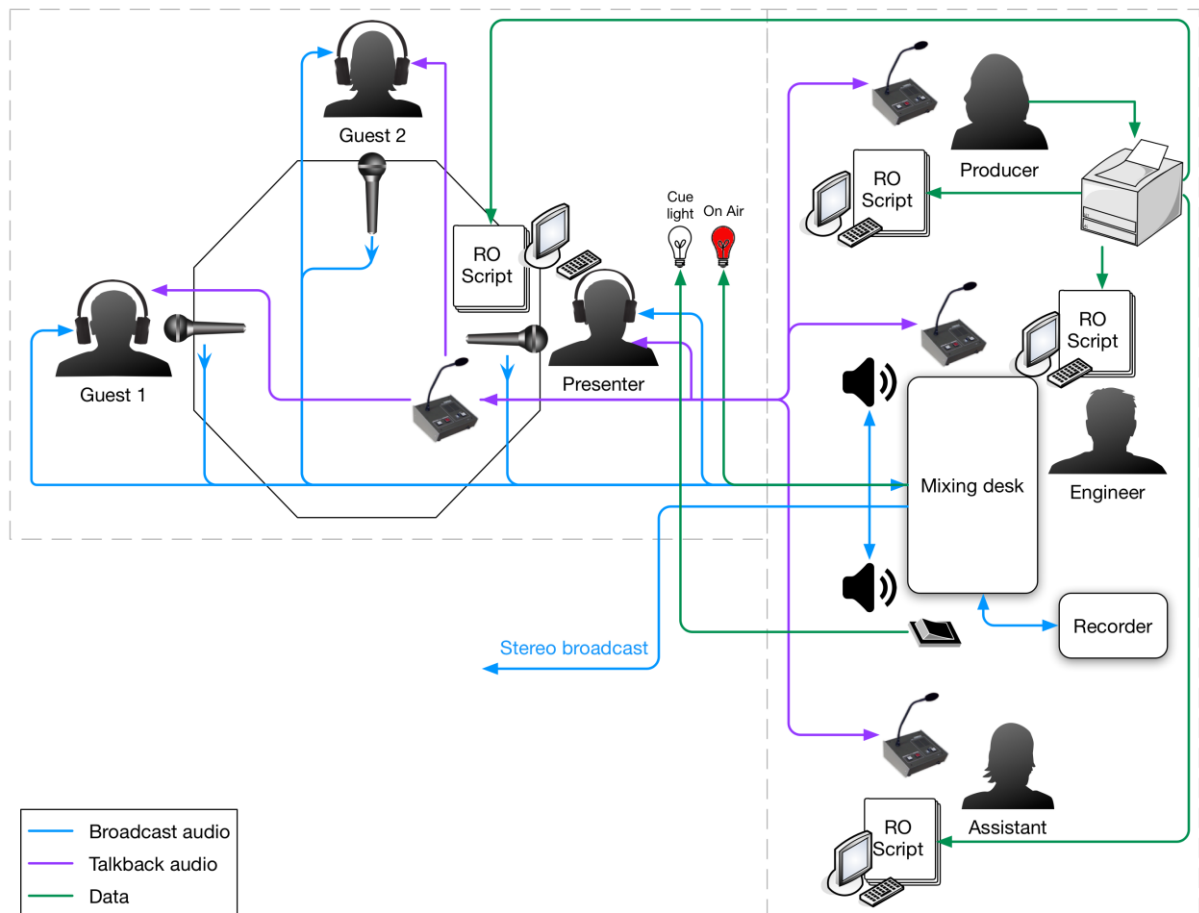


Figure 5: Existing schematics for a discussion programme production

## 4.5 Proposed object-based workflow

Aims:

- Capture identities of participants
- Integrate production documentation
- Integrate talkback
- Integrate signalling

When each person enters the studio (including the guests), they identify themselves and their role using their respective interfaces (which might or might not include badge or facial recognition). This identification process adapts each interface to the operator's preferences (if they have any). The running order and script are present in the production system. They can be updated by the producer on-the-fly and these changes are propagated to the other team members who are notified.

During the broadcast, the presenter reads the running order and script from their interface. The assistant keeps track of which place the programme currently is in the running order and marks the points which it changes using their interface. The engineer can see using their interface which contributors are on which faders, and they use the faders to balance the levels.

All of the team members can use their interface along with their individual microphone, loudspeakers and headphones to communicate with any other team member.

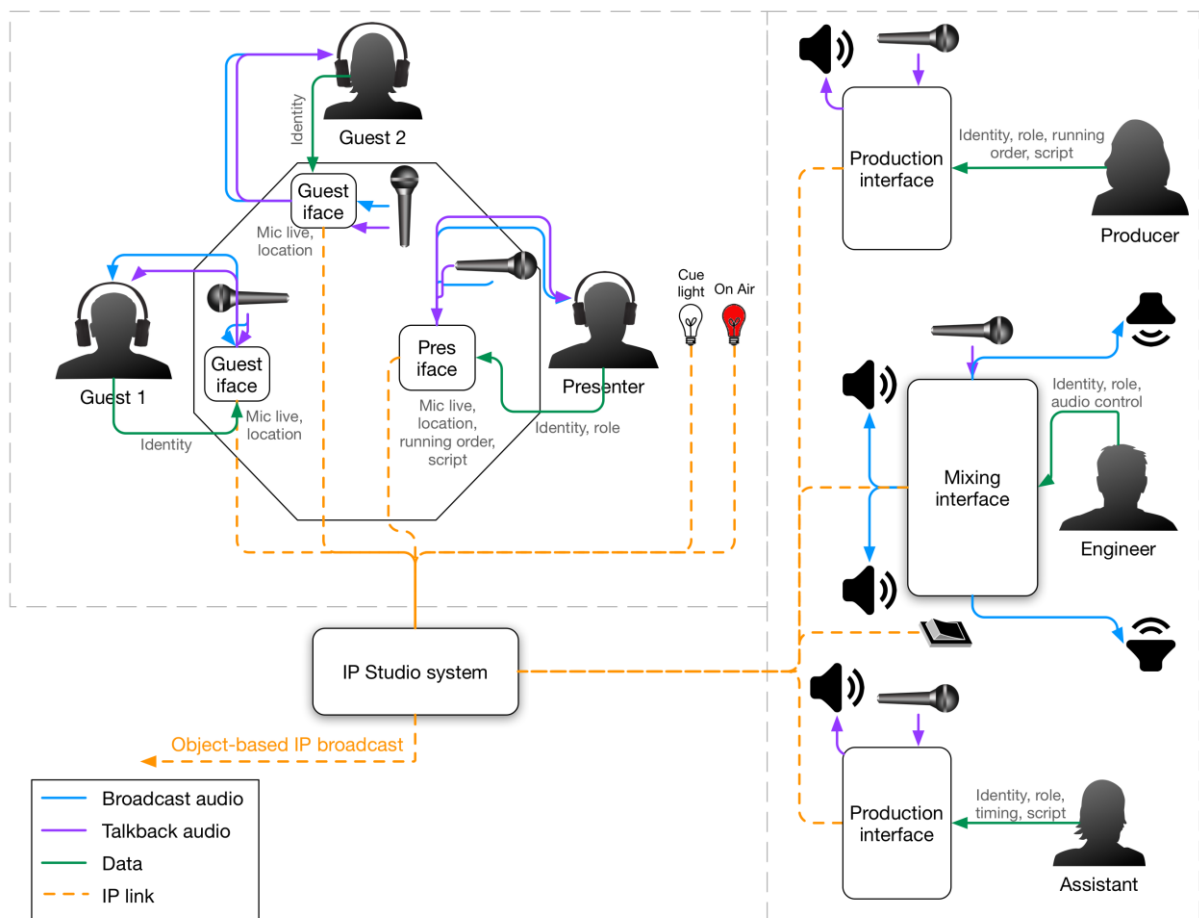


Figure 6: Object-based schematics for a discussion programme production

## 5 Case study 2: Magazine programme

### 5.1 Overview

A magazine show is a mixed programme that normally includes news items, reports, interviews and discussions. It is one of the more complex and demanding forms of live broadcasting and therefore needs careful planning and preparation of all elements. Due to the complexity, the production team quite often gets enlarged by the addition of more producers or secondary presenters. Examples of magazine shows include “Today” (BBC), “Broadcasting House” (BBC), “Front Row” (BBC) and “In Tune” (BBC).

Magazine programmes often combine pre-recorded elements into the live production, using packages created by the producers, or interviews that were recorded ahead of time. Remote contributors are also commonly involved, by connecting to another studio in a different part of the country, or using a telephone or Skype connection. Certain magazine shows will feature live music as part of the programme, others might play pre-recorded music or archive material.

These shows can either cover general current affairs topics, or can be based around one particular subject. This can often be topical and therefore is chosen relatively last-minute, or based around the guests that are featuring on the show. After a topic has been chosen, the producer puts together a running order, writes EPG summaries and presentation details and books guests. They will also commission some short packages for the programme, which are created by the assistant producer(s). After a period of research, the producer will write intros and outros to each part of the running order, probably more so than in the discussion programme. The producer may also fill out a compliance form to highlight any sensitive editorial content.

Before broadcast, the producer will brief the presenter(s) on the topic and the guests and the engineer will set up any communication links to remote studios (A12). Following the broadcast, any music played must be reported (A9) and a final script of the ‘programme as broadcast’ must be filed (A10). Any podcasts or website clips of the programme must be edited together and submitted to the relevant media management system.

### 5.2 Roles

- Producer
- Assistant
- Engineer
- Presenter
- Guests and contributors
- External contributor or correspondent

### 5.3 Equipment

- Mixing desk and monitoring loudspeakers
- Player and recorder
- Microphones and headphones
- Talkback units
- Printer

- Foot pedal and cue light
- Internal and external pre-production studio
- Telephone balance unit (TBU)
- External studio

## 5.4 Existing workflow

The workflow is the same as in Case Study 1 (Discussion programme), with the following additions:

Before the show is broadcast, producers, assistants and/or engineers will use a digital audio workstation (DAW) to pre-produce packages for playout during the show (A7).

The assistant will monitor social media, SMS and email for any audience contributions or responses to the show. These will be filtered into a suggested set that is presented to the user, either through a digital interface or using a printout that is handed to them (A26).

Having set up the communication links to external studios and contributors on the phone (A12), the engineer will mix these into the broadcast output and ensure the audio is correctly routed to the presenter and other guests.

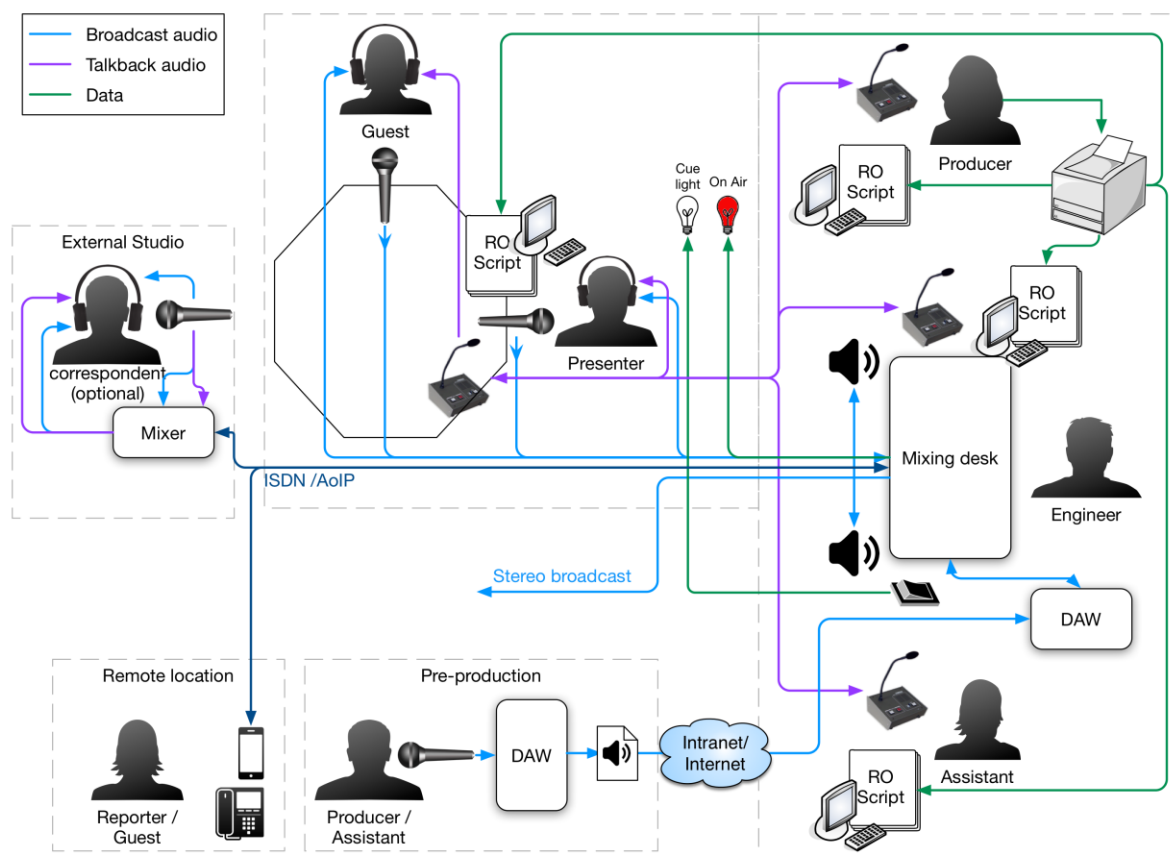


Figure 7: Existing schematics for a magazine programme production

## 5.5 Proposed object-based workflow

**Aims:**

- Capture identities of participants
- Integrate production documentation
- Integrate talkback
- Integrate signalling
- Extend production system functionality to remote studio and mobile phone
- Enable pre-production of object-based material

The object-based workflow is the same as in Case Study 1 (Discussion programme), with the following additions:

An external studio will be connected via an IP link. The guest there will have a similar interface to those in the studio such that the location is reported and the guest can identify themselves.

Reporters in the field can use a mobile app to link into the broadcast, communicate to the production team over talkback, see the script and running order and report live through the phone.

Producers and assistants will be able to use an enhanced DAW to produce object-based content for live playback.

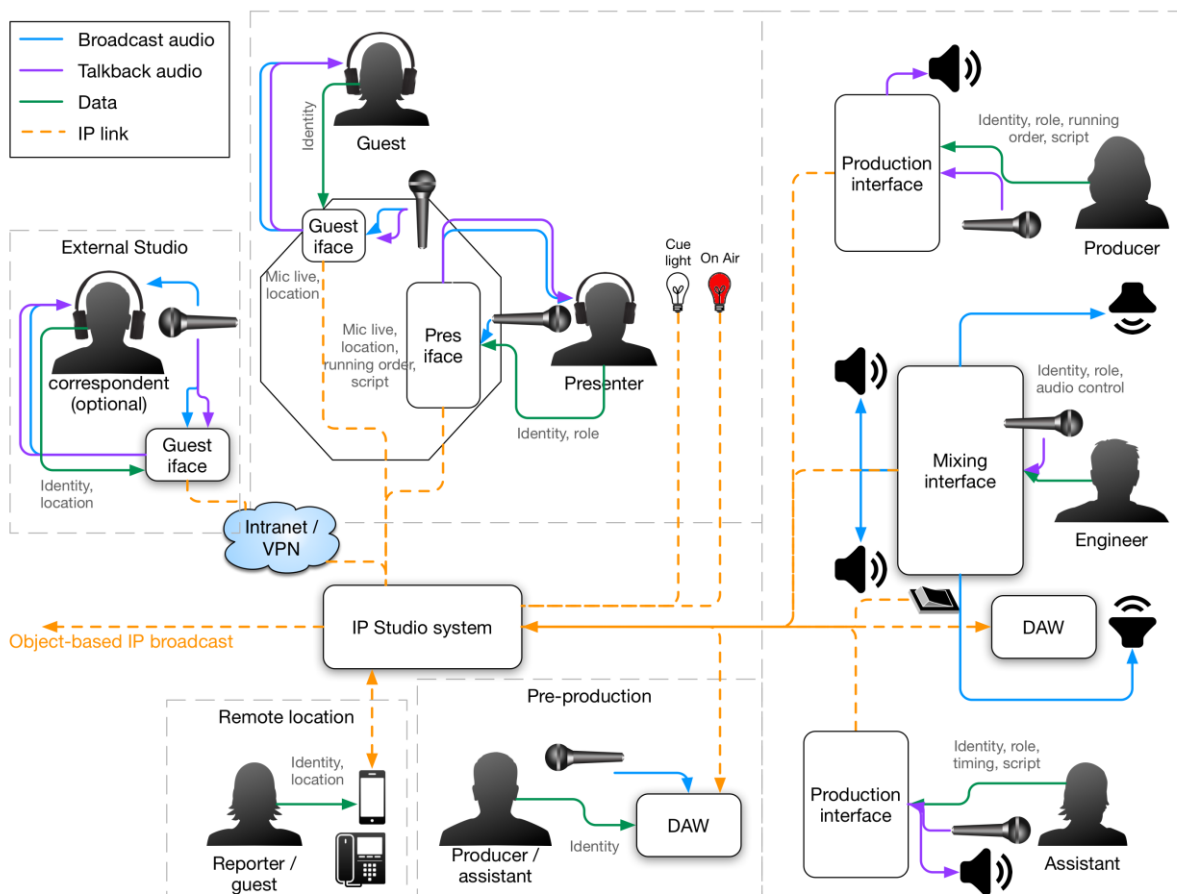


Figure 8: Schematics for an object-based magazine show

## 6 Case study 3: DJ show

### 6.1 Overview

A 'DJ show' is a music-based programme presented by a disc jockey who selects and introduces the music tracks. This type of show is distinct from discussion and magazine shows because the sound is mixed by the presenter themselves. It is also different because the production team are in the studio with the DJ, so no talkback is required, except for outside sources.

Music is mainly played through a music playout system that has a large catalogue, however occasional tracks will be played using a CD player, or from an MP3 file. Guests are frequently invited into the studio, which is handled similarly to the discussion programme. Most DJ shows will include phone calls from listeners, either to suggest songs or to play on-air games. Some DJ shows also incorporate live music.

The producer role involves finding and booking guests, and populating a running order for the show. The DJ will prepare a music playlist ahead of time, or use the station's music rotation system to play the current most-popular tracks. There is no continuity announcer, so no presentation details are required. The EPG summaries are usually much the same for every show, unless there is a special edition. Sometimes interviews are pre-recorded and played out live. For some shows there are two DJs; in this case one will control the mixing desk and the other will, in effect, act as a guest.

### 6.2 Roles

- DJ (presenter)
- Producer
- Assistant
- Guests and contributors

### 6.3 Equipment

- DJ mixing desk and headphones
- Recorder
- Microphones and headphones
- Printer
- Telephone balance unit (TBU)
- Music playout system
- Cart player

### 6.4 Existing workflow

During the show, the DJ/presenter will go through the running order (A2), which is usually quite high-level. They will play music from the playout system (A14) and chat in-between tracks, either by themselves or with guests. Occasionally they will play jingles using a 'cart player' system (A21). The assistant will monitor social media, SMS and email, and send the presenter some contributions which they can read out on air (A26). The producer and assistant will also help organise arrival and departure of guests, and phone calls.

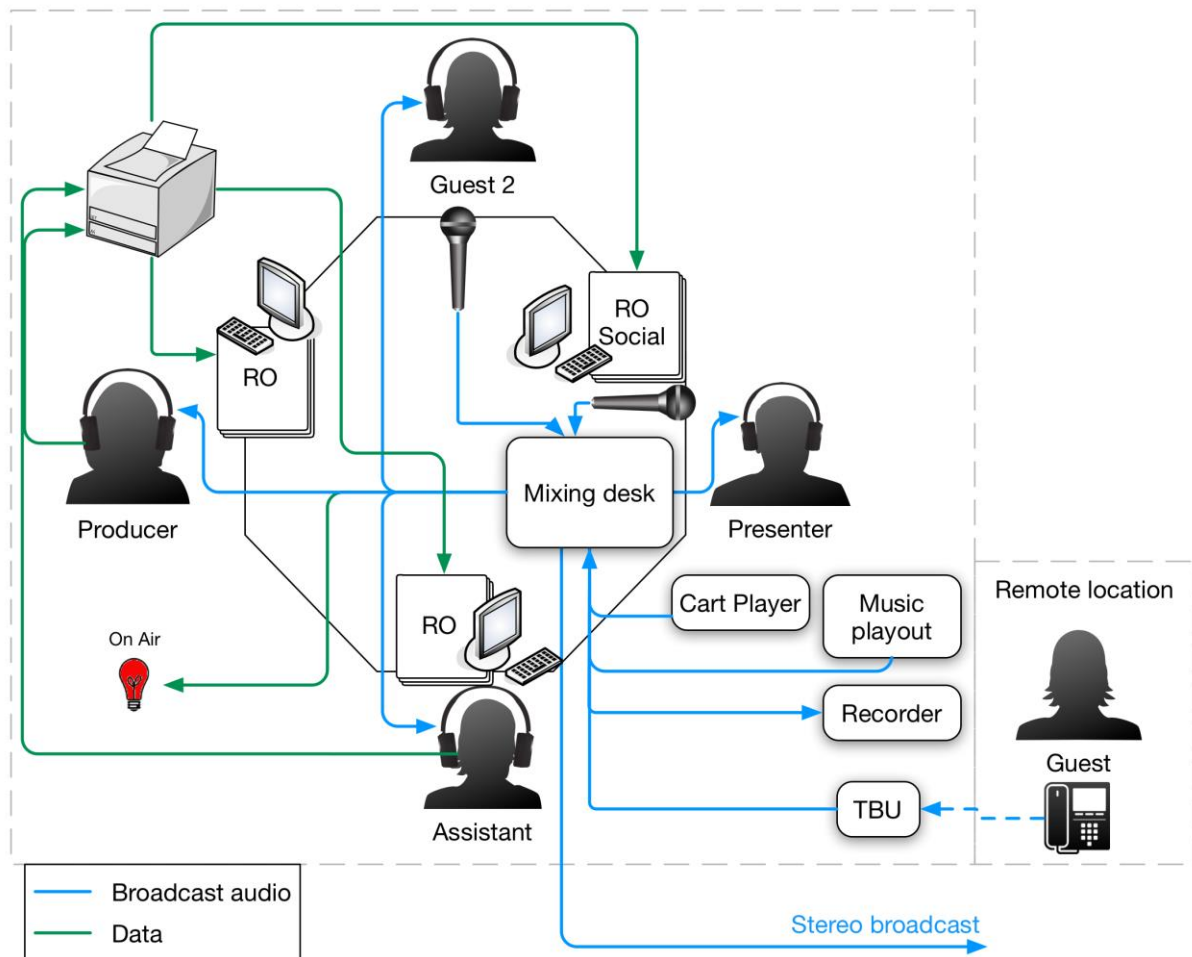


Figure 9: Existing schematics for a DJ show



## 6.5 Proposed object-based workflow

### Aims:

- Capture identities of participants
- Integrate production documentation
- Integrate social media contributions
- Add music and jingle playback
- Maintain support for telephone contributions

Changes like those in the discussion and magazine programmes would be made for the object-based system. The music playout and cart player would be built-in, allowing the DJ to control these from one place rather than having to use two separate interfaces.

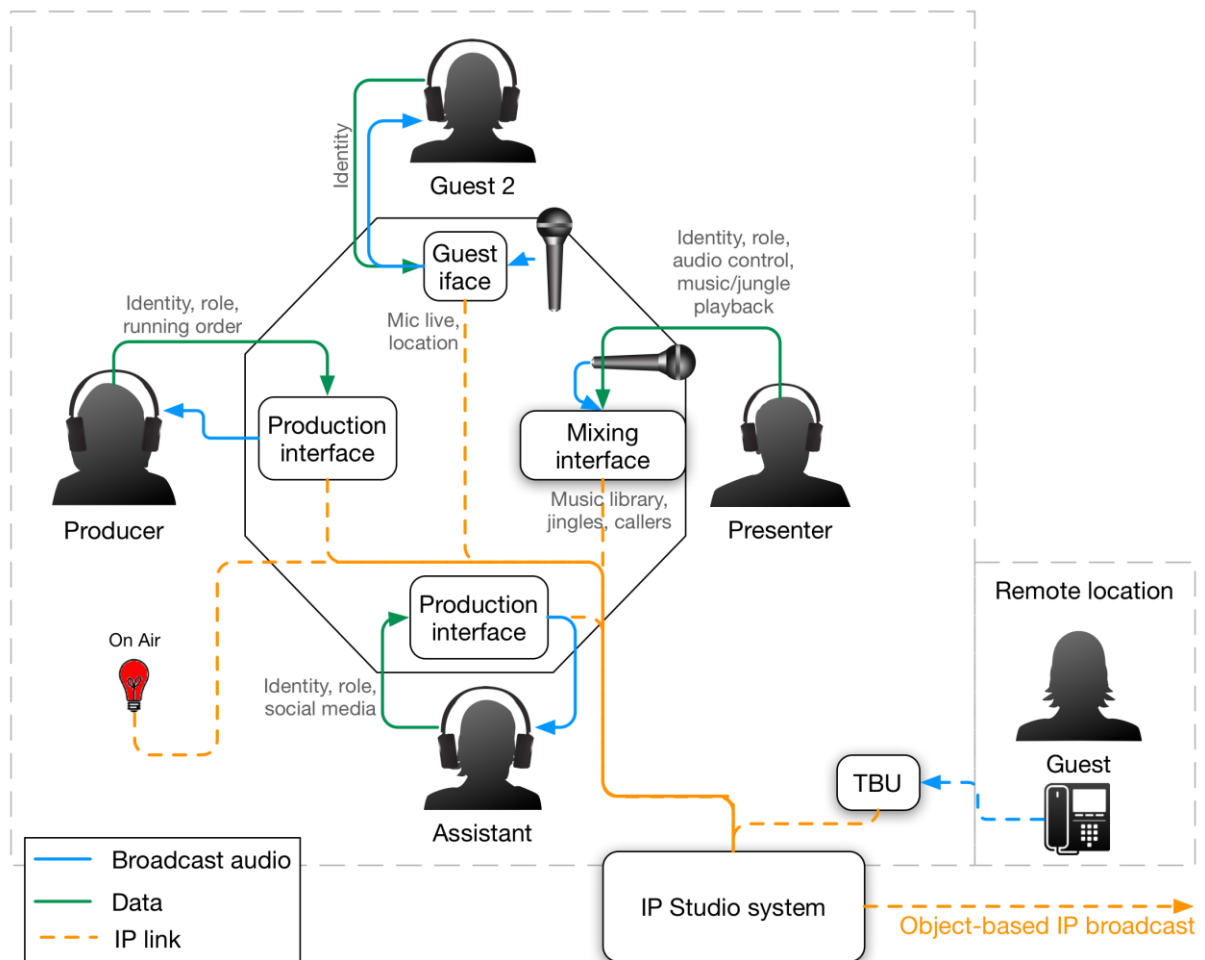


Figure 10: Schematics for an object-based DJ show

## 7 Case study 4: Live music outside broadcast

### 7.1 Overview

This case study will consider the live outside broadcast (OB) of a classical music concert (e.g. BBC Radio 3 - "Radio 3 Live in Concert") from a venue that is remote from the radio studio. The show is made up of live performances combined with a presenter reading from a script, or conducting interviews in the venue.

This type of programme is distinct from the other case studies because it uses an outside broadcast truck to bring a miniature studio to the venue. This is because a large number of microphones are used to capture the performance, and it was previously impractical to send all of these signals back to the studio.

Prior to the live broadcast, there will be a rehearsal where the engineer can set levels and balance the microphones. An assistant engineer will be on site to help make adjustments to the equipment in the venue.

The producer will do research ahead of the concert, and work with the presenter to put together a script for the show. This type of programme is much more highly scripted than the other case studies. The presenter will be at the venue with an assistant who can help them organise interviewees.

### 7.2 Roles

- Producer (in OB van)
- Assistant (in venue)
- Presenter (in venue)
- Engineer (in OB van)
- Tonmeister (in OB van, optional)
- Engineer (in studio)
- Assistant engineer (in venue)
- Continuity announcer (in studio)

### 7.3 Equipment

- OB truck with mixing desk and speakers
- Recorder/player
- Microphones
- Stage box
- Radio talkback units
- Cable or satellite link to studio
- Mixing desk and monitoring loudspeakers (in studio)

## 7.4 Existing workflow

The producer, engineer, and (optional) Tonmeister sit in the OB van whilst the presenter, assistant and assistant engineer are in the venue. Radio talkback is used to communicate at the venue.

A stage box is used to amplify and connect the multiple microphone signals in the venue to the mixing desk in the OB van. During rehearsal, the engineer (and Tonmeister) will balance the microphones so that they sound from the very beginning of the live broadcast. During the broadcast, the microphones are mixed down to stereo or 5.1 and sent via cable and/or satellite link to the radio studio where optionally they can be monitored.

As the live broadcast relies on communication links, a continuity announcer is available to immediately step in should the link fail. A pre-recorded item will be on standby which can be played back in the studio in the event the link goes down.

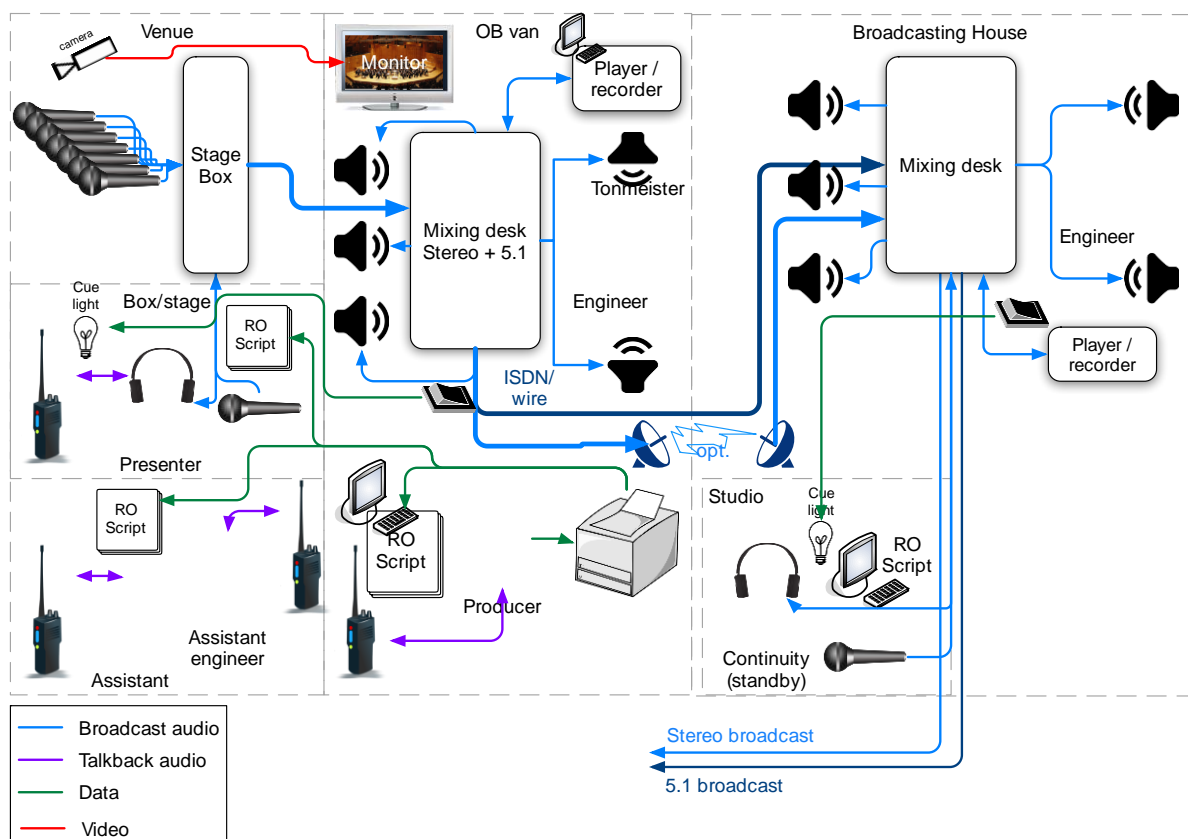


Figure 11: Existing schematics for a live music outside broadcast

## 7.5 Proposed object-based workflow

### Aims:

- Remove need for OB van
- Integrate video camera monitoring
- Integrate signalling
- Enable 3D audio panning
- Integrate production documentation
- Partly integrate talkback

An IP-based production system combined with a sufficiently fast communication link would allow the stage box to be effectively be extended into the radio studio. Crucially, this would mean that an OB

truck would not be needed which represents a significant cost saving. An IP production system would also allow other types of data such as video to be included in the production workflow, which could also assist in the communication between team members.

The object-based nature of the system would allow the engineer to pan audio objects anywhere in 3D space to create immersive audio scenes. This is especially beneficial for rich auditory experiences such as those available in live music performances.

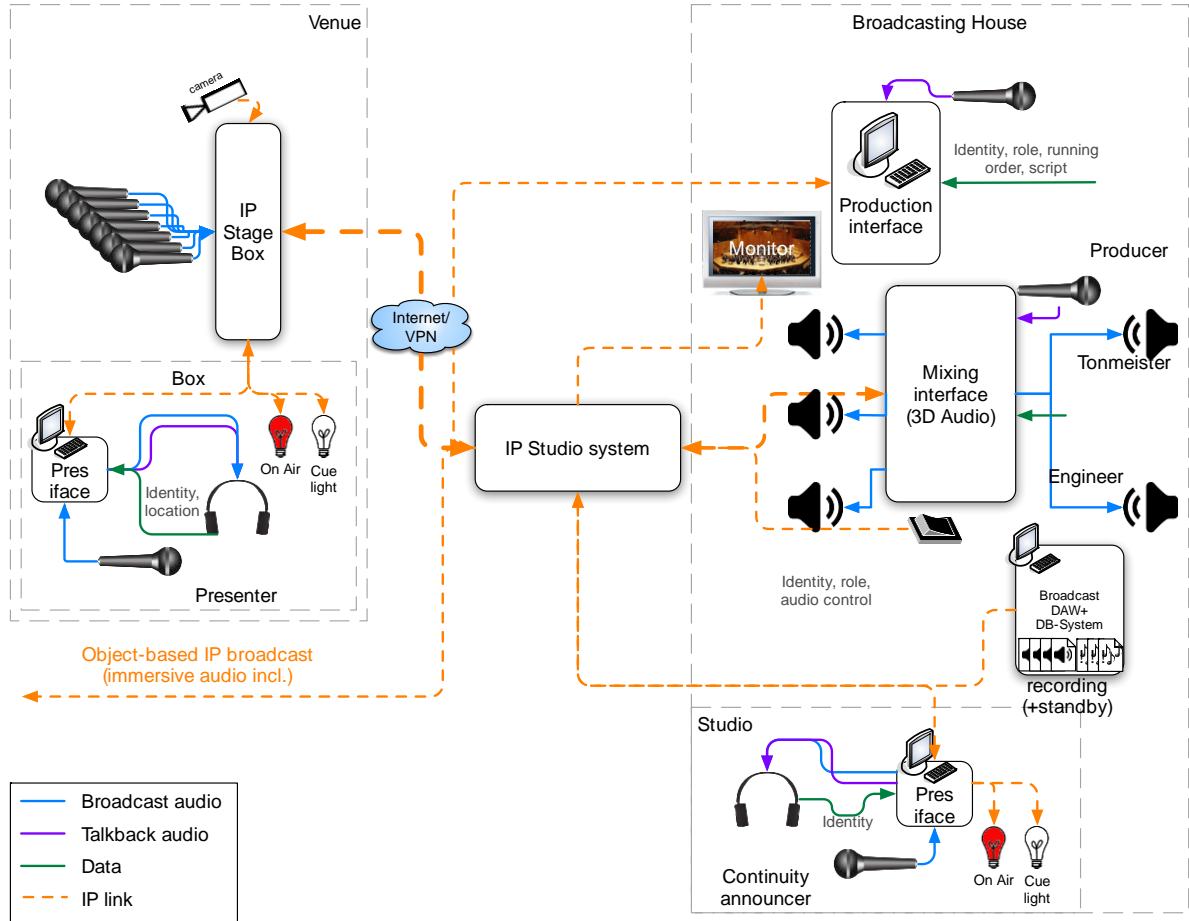


Figure 12: Schematics for an object-based live music outside broadcast

## 8 List of user actions

This section lists the user actions from the roles section. Where appropriate, each action is additionally broken up into sub-actions which should be considered when designing and implementing an object-based production system.

### A1 Write running order and script, modify before and during broadcast

- List each programme item
  - Title
  - Contributors
  - Estimated running time
  - Text of script (optional)
- Add/delete/re-order items

### A2 Read running order and script, receive updates

- Display of running order items
- Indicate current position in broadcast
- Notify user when a change is made, and mark which bit has changed

### A3 Write and submit EPG summaries before broadcast (BBC)

- Write programme description in three lengths: short, medium and long

### A4 Write and submit presentation details (intro/outro for continuity announcer) before broadcast

### A5 Fill out and submit compliance form

### A6 Communicate with other contributors over talkback

- Display identities of programme contributors
- Select identity to talk to contributor through their headphones

### A7 Create pre-recorded items to play during broadcast

### A8 Track timings in relation to the running order

- Display countdown until end of current item
- Record actual time taken for each item

### A9 Report the music that was played during the broadcast

- Determine identity of track, ideally using ISRC
- Record start and end times of playback that was audible during broadcast
- Submit data to music reporting system

### A10 Write and submit a 'programme as broadcast' document (BBC)

- Write description of programme
- Add music reporting details
- Submit to archive system

### A11 Mix, pan, EQ microphone signals

### A12 Route links to/from outside sources

### A13 Play pre-recorded items

A14 Play music track from music playout system

- Search and navigate music library for desired tracks
- Add tracks to playlist/schedule for playback during programme

A15 Record live output

A16 Send visual signal to the presenter (cue light)

A17 Edit pre-recorded audio

A18 Turn broadcast output into a podcast version (BBC)

A19 Create short clips from the broadcast output for the website (BBC)

A20 Monitor audio quality of studio output

- Listen to output to ensure audio signal is clean
- Ensure loudness levels are consistent within and between programmes
- Ensure audio output complies with broadcast standards

A21 Play jingle from 'cart player' system

- Load selected audio clips into playback interface
- Press clip to playback

A22 Read presentation details

A23 Make time-stamped notes during performance to assist editing in post-production

A24 Listen to studio output over headphones

A25 Listen to studio output over speakers

A26 Monitor and filter social media, SMS and email. Send selected contributions to presenter

- View live contributions from audience
- Pick out good contributions
- Send select contributions to presenter

A27 Read musical score, follow along with music

[end of document]